SITKA COASTAL HABITAT EVALUATION
FINAL PROJECT SUMMARY WITH MANAGEMENT RECOMMENDATIONS

A summary of habitat evaluation surveys conducted in the Sitka area during 1978-1980 with recommendations for protecting important habitat values within the urban area of Sitka.

by:
Kimbal A. Sundberg
Habitat Biologist

Marine/Coastal Habitat Management
Habitat Protection Section
Alaska Department of Fish and Game
Anchorage, Alaska 99502
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Submitted by: Kimbal A. Sundberg
Habitat Biologist
Alaska Department of Fish and Game
Habitat Protection Section
Marine/Coastal Habitat Management Project
333 Raspberry Road
Anchorage, Alaska 99502

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INTRODUCTION

The City and Borough of Sitka embarked upon the development of a District Coastal Management Program in 1979. In February 1979, the Alaska Department of Fish and Game entered into a contract with Sitka to furnish an inventory and analysis of known fish and wildlife resource and habitat information for the Borough area as well as a summary of coastal management issues concerning fish and wildlife resources and their habitats. Sitka retained the consulting firm of R.W. Pavitt and Associates to provide the remainder of the inventory and analysis of coastal resources, issues, goals, and objectives. These combined efforts culminated in the publishing of the "Sitka Coastal Management Program Phase I Report" by the City and Borough of Sitka in October 1979.

Phase II of Sitka's Coastal Management Program began immediately following the completion of Phase I. As a result of the success of Phase I, the City and Borough of Sitka and the Alaska Department of Fish and Game signed a joint Memorandum of Understanding (MOU) in November 1979 to undertake additional research on coastal habitats with special emphasis on Sitka Sound and the urban area of Sitka. Funding for the Phase II effort was provided by the Office of the Governor, Division of Policy Development and Planning, Office of Coastal Management.

Specifically the MOU called upon the Department of Fish and Game to:

1. Evaluate and map individual streams and lakes along the 15 mile Sitka road system to delineate fish species, spawning areas, and

other sensitive habitat areas; identify adjacent land and water use practices that affect fish and wildlife habitat; and make recommendations for maintaining or enhancing specific stream and lake habitats within the Sitka "urban" area.

2. Evaluate and map coastal wetlands and tidal flats to delineate important habitat use areas for birds and other wildlife. Document past and present impacts to wetland habitats and make recommendations for the conservation of important wetland habitats.

3. Identify and characterize waterfront marine habitats including estuaries, tidal flats, rocky shores, and man-made structures. Describe and document the biological and physical components of these habitats and develop a management system for these areas based upon their relative sensitivities to various types of waterfront development.

This report is a summary of the results of the Phase II study with general and specific recommendations for habitat management. A series of detailed technical reports covering the subjects of: 1) freshwater habitats, 2) wetland habitats, and 3) marine/estuarine habitats and marine circulation, are available to provide backup information for the habitat management recommendations contained in this report. Examples of the technical report products are found in Figures 2 through 16.

STUDY AREA

The study area (Figure 1) includes the Sitka Sound region bounded on the north by Nakwasina Passage, on the south by Goddard Hot Springs, on the west by Kruzof Island, and on the east by Silver Bay. Specific study sites were selected within this area because of their known fish and wildlife value, their sensitivity to coastal development, and their representation of habitat type and geographic area.

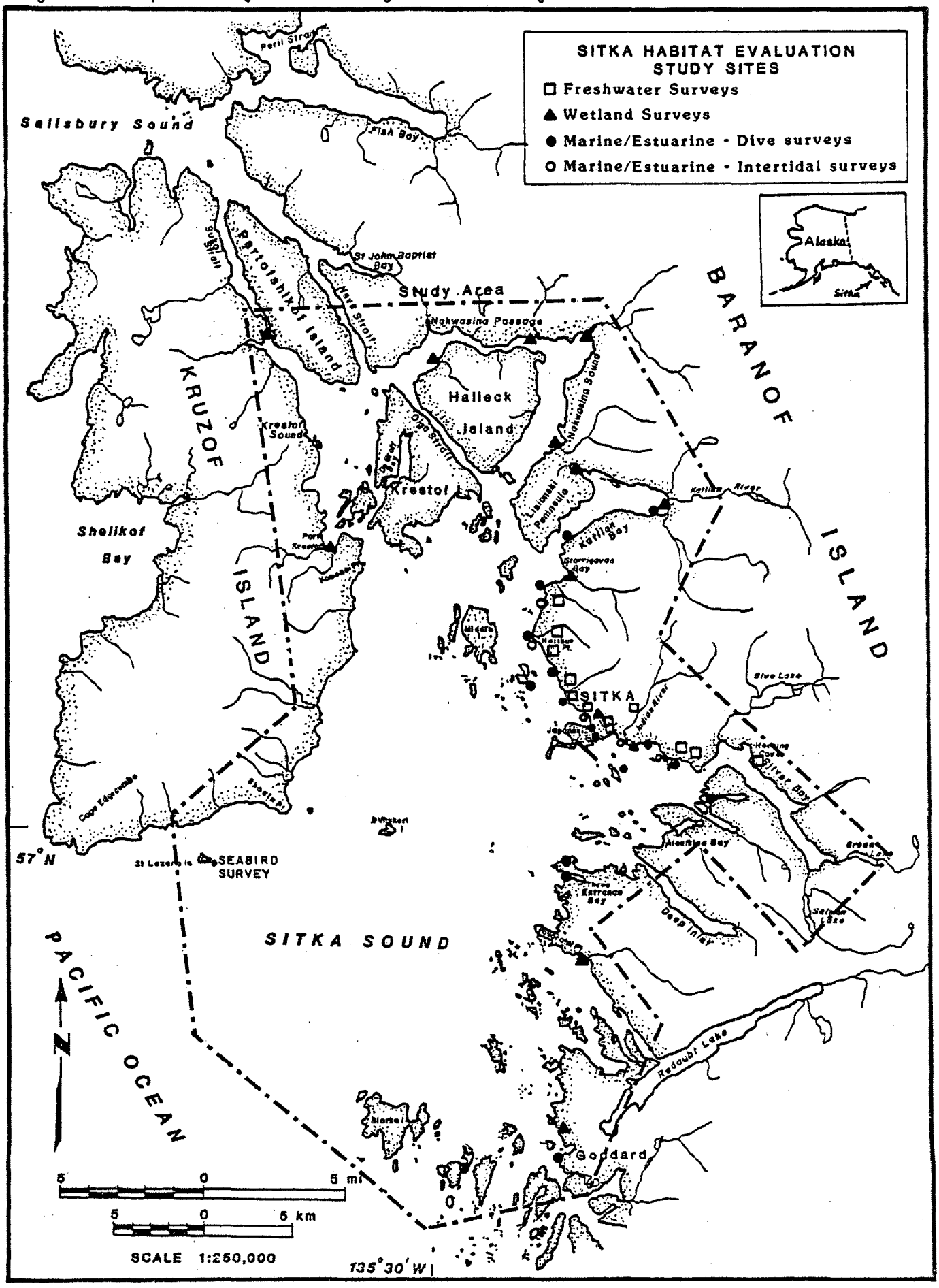
The period of study extended from 1979 to 1980 and spanned the four seasons: fall, winter, spring, and summer.

METHODS

Standard methods were used to survey fish and wildlife habitats within the study area. A brief description of the methods follows:

1. Freshwater Habitats. A determination of fish species present in 12 streams along the road system was accomplished by consulting the available information, both published and unpublished, and by sampling with standard minnow traps baited with salmon eggs. Stream drainages were walked their entire length from tidewater to the upper limit of known fish habitat to note potential spawning areas, rearing areas, obstructions to fish passage, condition of stream channel and banks, and adjacent land use practices and impacts. Mapping techniques included the use of low altitude 35

Figure 1. Map of Study Area Showing Habitat Survey Sites



millimeter color infrared (CIR) photography enlarged to a scale of one inch = 140 feet. This was supplemented with U.S. Forest Service one inch = 1,320 feet color photographs and NASA/Ames one inch = one mile high altitude CIR photographs. Photographic interpretations were verified by ground surveys at selected locations.

2. Wetlands Habitats. Wetland habitats were initially identified and mapped by synthesizing the available knowledge of the area, by consulting aerial photography, and by conducting limited surveys by car, boat, aircraft, and on foot. Thirteen areas were selected for additional surveys and of these, seven were selected for more intensive floristic and surface soil characterization.

One meter wide belt transects were established across representative plant zones at each of the seven wetlands. The transects were sampled at one meter intervals to determine plant species, elevation, percent cover, and surface soil type. CIR photos were used to map major plant zones and wetland features.

Bird surveys were conducted at all major coastal marshes and their adjacent waters within the study area during the fall, winter, spring, and summer. Opportunistic sightings of Sitka black-tailed deer, brown bear, and small mammal use in wetlands were also made during the 1979-80 field season. Surveys were conducted on foot, in a 13 foot open skiff, in a 29 foot power boat, by car along the

road system, and by aircraft. Survey data recorded included: species present, relative numbers, and observed habitat use.

3. Marine/Estuarine Habitats. Marine and estuarine habitats were evaluated through intertidal surveys, subtidal surveys, and a drift bottle study.

Intertidal surveys were conducted by walking a linear transect through the intertidal zone from the higher high water line to the lower low water line to record and sample epifauna, epiflora, infauna, substrate, and elevation within major life zones. Infauna was sampled by shovel and washed through a one millimeter mesh sieve. All intertidal surveys were conducted during minus tides in May.

Underwater surveys were conducted by making scuba dives along a 100 meter transect tape anchored at mean higher high water and run perpendicular to the shoreline out to 100 meters length or 24 meters (80 feet) depth, whichever occurred first. Data on surface substrate, depth, epiflora, and epifauna were recorded every five meters along the tape. Limited infaunal sampling was done by hand digging. Underwater 35 millimeter photos were taken along the transect to supplement observations.

A drift bottle study was initiated by releasing 3,500 plastic bottles at 35 locations within Sitka Sound. Each bottle contained

a highly visible, sequentially numbered card instructing the finder to record the time, place, and date the bottle was found. Data obtained from returned cards was used to interpret the net surface circulation within Sitka Sound during the study period.

RESULTS

The results of the Phase II field studies include the following:

1. Freshwater Habitats. Sitka area streams are typically short, steep drainages with highly variable flows and unstable beds. All of the surveyed streams provide habitat for pink salmon, coho salmon, and Dolly Varden char. Pink salmon were the most numerically abundant species in all streams. Chum salmon, cutthroat trout, and steelhead/rainbow trout are also present in several systems. Sockeye salmon occur in suitable lake/stream systems, most notably Salmon Lake. Productivity of anadromous streams varies from year to year depending upon stream flows, temperature, and the fluctuating numbers of spawning salmon. Table 1 summarizes the peak salmon escapements from the past twenty years in seven Sitka area streams. Pink salmon escapements in the surveyed streams ranged from less than 100 in small creeks, to over 150,000 in the larger drainages. Peak pink salmon spawning generally occurs during odd numbered years with lower numbers during even years. Low flows combined with extended periods of sub-freezing weather can severely limit salmon

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Table 1. Peak Salmon Escapement Estimates for Major Sitka Area Streams

	Katlian River 113-44-003			South Fork Katlian 113-44-005		Starrigavan Creek 113-41-015			Granite Creek 113-41-017	Indian River 113-41-019		Sawmill Creek 113-41-021	Salmon Lake Creek 113-41-032			
Year	Pink	Chum	Coho	Pink	Chum	Pink	Chum	Coho	Pink	Pink	Coho	Pink	Pink	Chum	Coho	Sockeye
60	400	4,000	NS	200	18,000	2,500	NS	NS	NS	NS	NS	NS	2,400	NS	NS	NS
61	1,200	NS	NS	11,000	NS	2,000	NS	NS	NS	NS	NS	NS	4,500	NS	NS	NS
62	1,500	NS	NS	20,000	NS	500	NS	NS	NS	500	30	NS	NS	NS	NS	NS
63	4,500	NS	NS	35,000	NS	7,000	NS	NS	NS	300	NS	NS	6,000	NS	NS	500
64	400	NS	600	5,000	NS	500	NS	NS	NS	300	NS	NS	4,000	NS	NS	NS
65	11,000	NS	NS	11,300	NS	5,000	NS	NS	NS	500	NS	NS	6,700	200	1,000	NS
66	2,000	NS	NS	2,250	2,250	500	NS	NS	NS	300	NS	NS	500	NS	NS	NS
67	6,000	NS	NS	30,000	NS	500	NS	NS	NS	150	NS	NS	5,500	NS	NS	NS
68	2,000	NS	NS	4,000	NS	100	NS	NS	NS	NS	NS	NS	1,500	NS	NS	300
69	5,500	NS	NS	50,000	NS	1,000	NS	NS	NS	500	NS	NS	25,000	NS	NS	1,000
70	1,000	2,000	NS	1,500	1,000	300	200	NS	NS	NS	NS	NS	2,500	2,500	NS	2,000
71	5,200	NS	NS	21,000	NS	10,000	NS	NS	NS	300	NS	NS	NS	NS	NS	NS
72	300	NS	NS	1,200	NS	400	100	NS	NS	200	NS	NS	NS	NS	NS	NS
73	34,000	500	NS	55,000	200	5,300	NS	200	NS	500	NS	NS	5,000	2,000	NS	NS
74	1,000	300	NS	5,000	NS	6,150	NS	NS	NS	NS	NS	NS	700	NS	NS	NS
75	40,000	NS	NS	50,000	2,700	17,500	NS	NS	NS	NS	NS	NS	3,000	NS	NS	NS
76	500	1,000	NS	3,000	3,950	25,000	NS	NS	NS	NS	NS	NS	100	NS	NS	NS
77	120,000	NS	NS	125,000	NS	70,000	NS	NS	NS	17,500	NS	NS	70,000	100	NS	50
78	6,000	2,500	NS	8,000	3,000	48,800	NS	NS	1,000	2,000	NS	NS	5,500	300	NS	NS
79	100,000	NS	NS	155,000	NS	55,000	NS	300	*1,000	+13,000	96	1,000	16,500	NS	20	2,000
80	400	NS	NS	4,000	4,000	15,000	NS	2,000	200	2,900	110	NS	5,000	NS	NS	5

Sources: All data furnished by ADF&G, Commercial Fisheries Division unless otherwise noted.
*Bill Hughes, U.S. Fish and Wildlife Service.
+Dennis Lund, Sheldon Jackson College
NS - No survey data available

production in Sitka area streams. High flows, particularly fall freshets that can dislodge eggs from the gravels, will also adversely affect salmon production.

Sitka area streams and lakes provide important recreational and subsistence opportunities for Sitka residents, as well as providing the resource base for the local commercial salmon fishery. During the surveys, several freshwater systems were found where spawning and rearing habitat and water quality have been adversely affected by land and water use practices. The most significant impacts have occurred in Granite Creek, Indian River, Sawmill Creek, Swan Lake, and Turnaround Creek. However, these systems still provide important resource values to the community and will continue to support fish and wildlife resources with careful land and water management.

2. Wetlands Habitats. Wetlands comprise less than ten percent of the shorelands of Sitka Sound, yet many were found to be important coastal habitats. The term "wetland" as evaluated in this study, includes four broad categories:

   A. *Coastal Wetlands* - Coastal wetlands are low gradient shorelands that often occur at the heads of bays and on the alluvial deposits at stream mouths. This type of wetland tends to be relatively small and isolated when compared to the majority of the shoreline of Sitka Sound, which is characteristically steep and rocky. Sizes range from 4 acres at the mouth of

Indian River (Figure 2) to 160 acres in Katlian Bay (Figure 3). Coastal wetlands and their adjacent marine/estuarine waters were found to be high value feeding and resting areas for approximately 70 species of waterfowl and shorebirds. Peak bird usage is during the spring migration (Table 2). The use of coastal wetlands for nesting was found to be minimal. Typically, five plant communities (listed in order from the high intertidal zone landward to the forest) occur in coastal wetlands. They are: alkali grass *(Puccinellia nutkaensis)*, bluejoint grass *(Calamagrostis canadensis)*, sedge *(Carex lyngbyaei)*, beach rye-grass *(Elymus arenarius)*, and reed bent grass *(Calamagrostis nutkaensis)*. Figure 4 shows a typical vegetation profile for Katlian coastal wetland. The upper limit of a coastal wetland is usually sharply delineated by the forest fringe or shrub zone. In Sitka, the upland extent of coastal wetlands was found to be the upper extent of occasional saltwater influence.

B. *Estuarine Tidal Flats* - Estuarine tidal flats are comprised of deposits of silt, sand, and gravel and often occur in conjunction with coastal marshes. They are generally vegetated with scattered patches of algae. Some areas such as the Old Seaplane Turnaround Flats have extensive low intertidal and shallow subtidal eelgrass meadows. Invertebrate life is rich on tidal flats and in estuaries making them important feeding

Figure 2. Indian River, Coastal Wetland

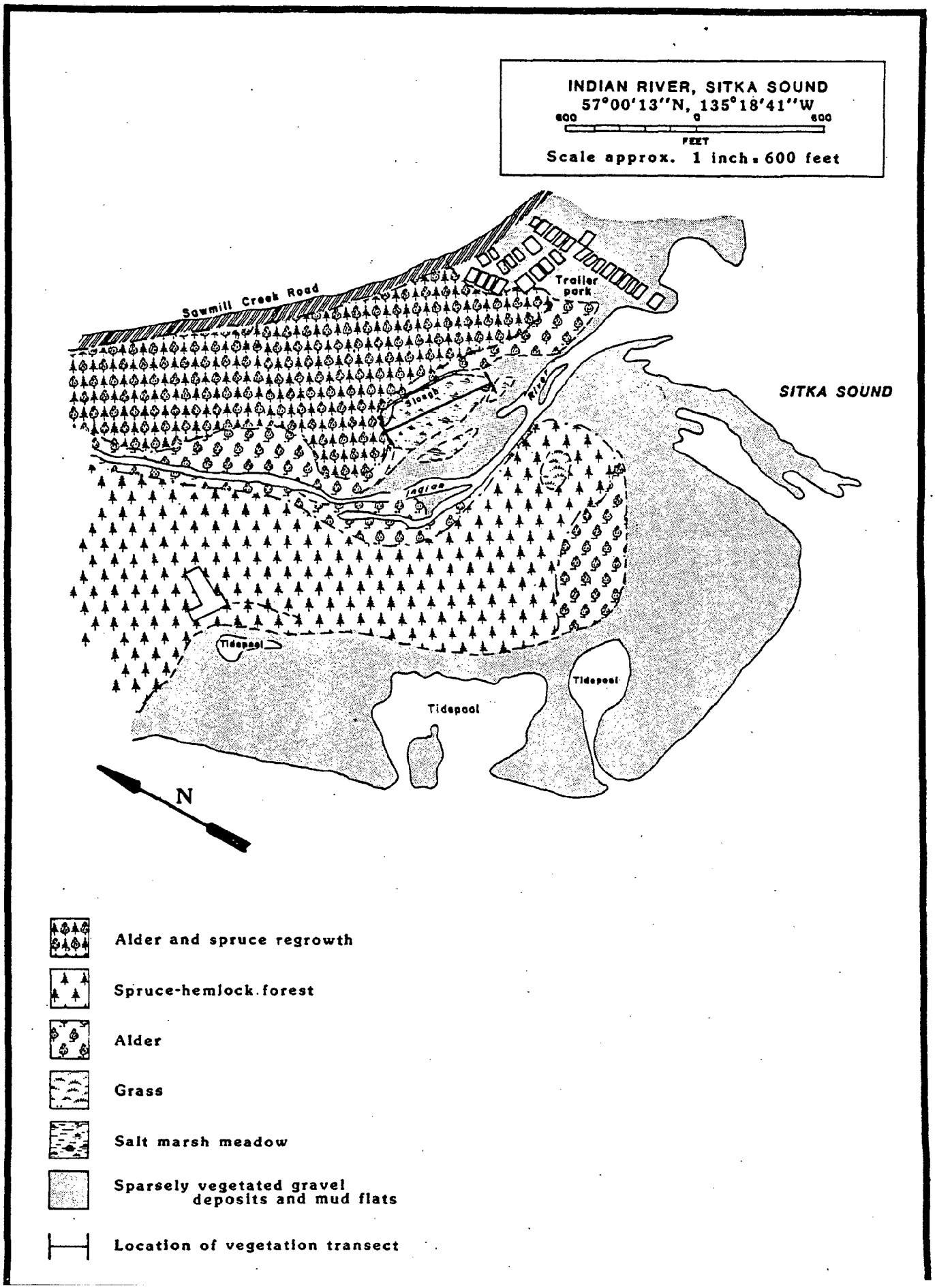
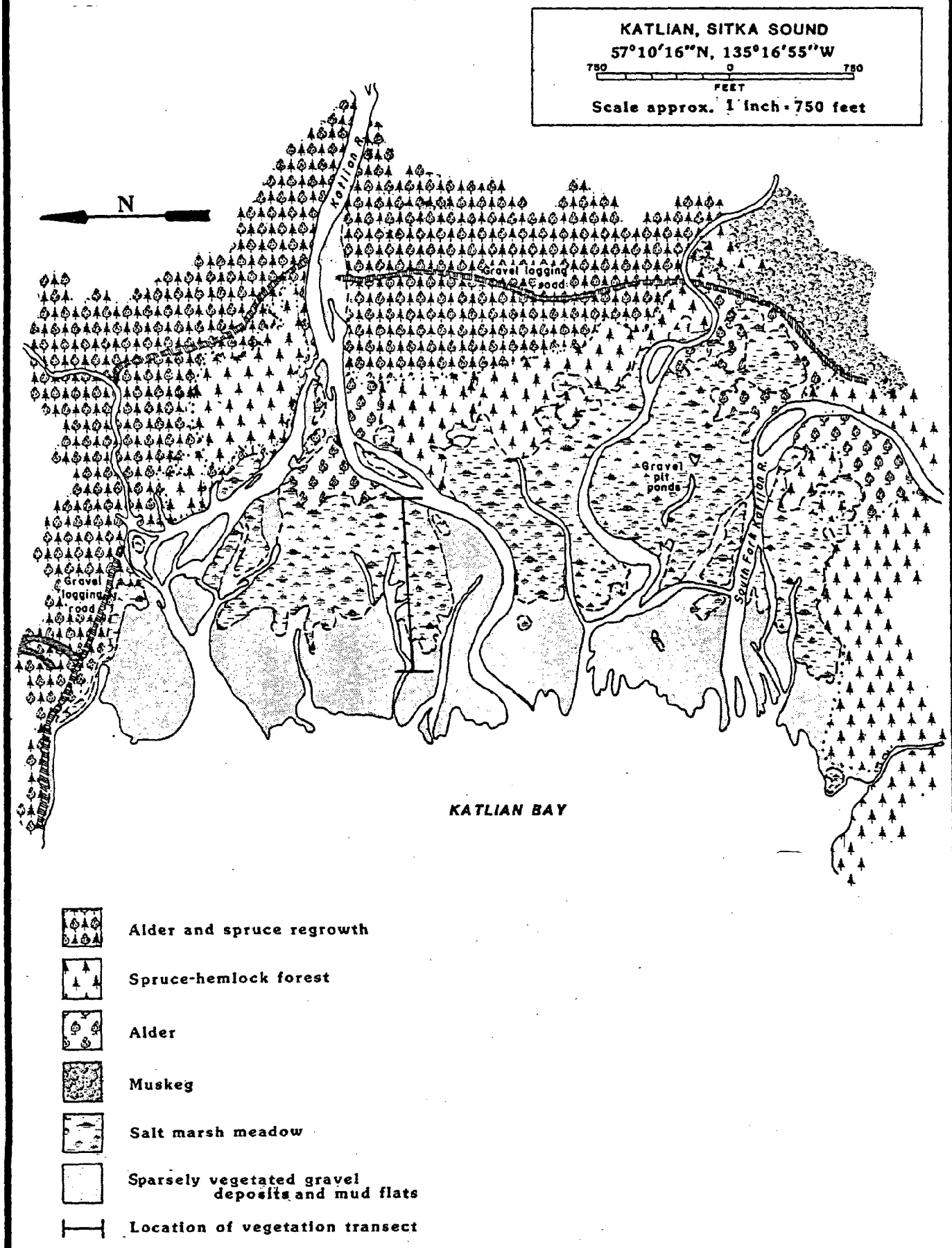


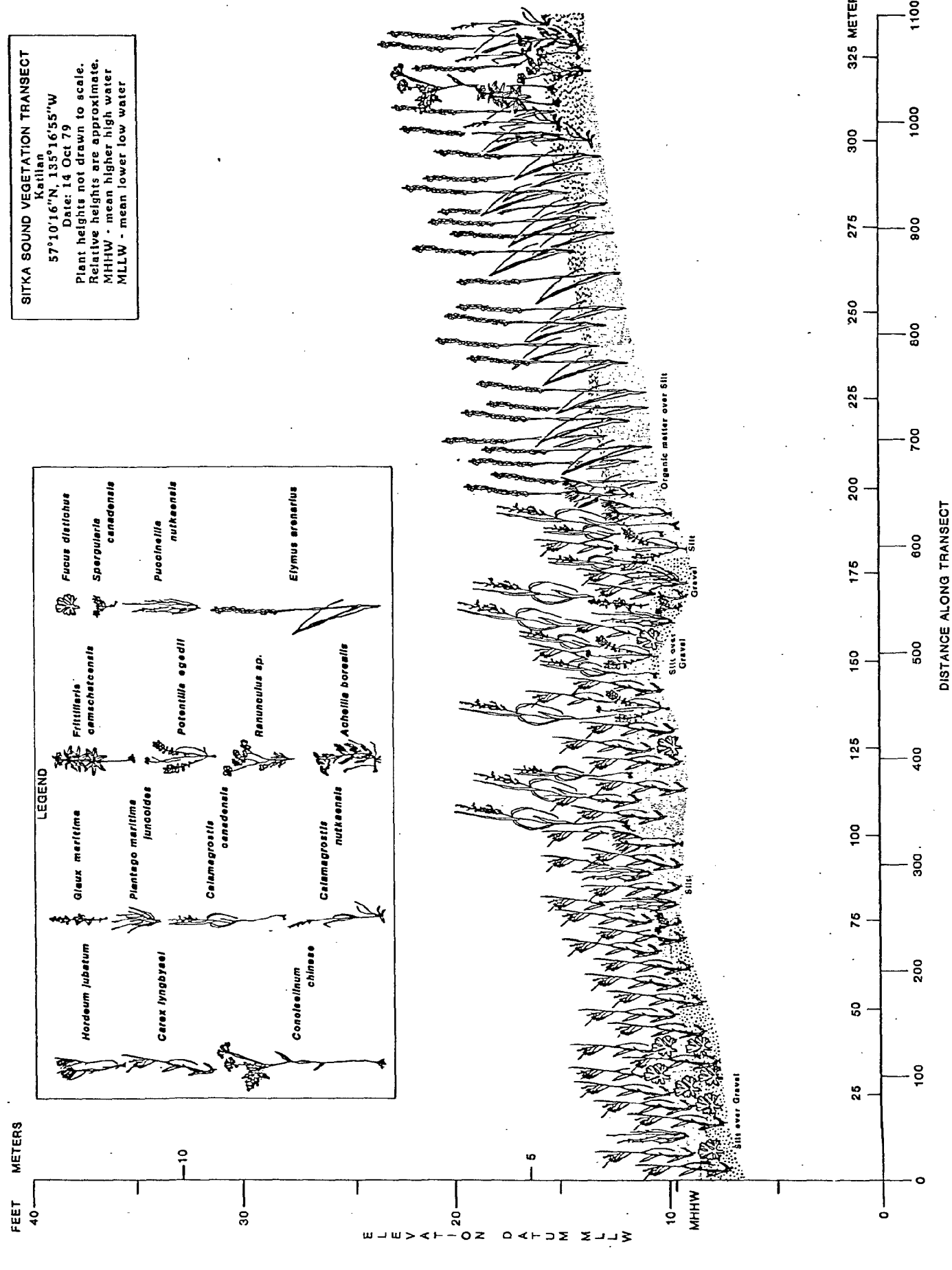
Figure 3. Katlian, Coastal Wetland



	SPRING 1980				SUMMER 1980	FALL 1979					WINTER 1979
	APR 1-15	APR 16-30	MAY 1-15	MAY 16-31	JUNE 1-26	AUG 27-31	SEPT 1-15	SEPT 16-30	OCT 1-15	OCT 16-31	FEB 18-29
LOONS and GREBES	4	9	9	2	6	—	—	4	8	14	45
SWANS	10	—	—	—	—	—	—	—	—	—	—
GEESE	157	57	148	2	8	80	1	—	36	95	70
DABBLERS	833	657	404	47	67	107	42	35	290	448	625
DIVERS and SEA DUCKS	2371	5535	1336	209	393	11	85	518	1961	1501	1493
SHOREBIRDS	582	4756	1621	45	28	32	275	93	142	50	15
SEA BIRDS	2	4	39	4	2	4	6	—	—	1	1

Table 2. Seasonal Populations of Selected Bird Species Groups Observed on Wetland Habitats. Data are from Surveys of the Roaded and North Areas.

Figure 4. Katlian, Coastal Wetland Vegetation Profile



areas for birds, fish, and wildlife. For example, eelgrass beds are utilized as spawning areas for Pacific herring and as rearing and feeding areas for juvenile salmon, crabs and shrimps. Eelgrass beds are also an important source of primary productivity and export nutrient energy to adjacent estuarine and marine systems.

C. *Freshwater Wetlands* - Freshwater wetlands occur in conjunction with lakes, potholes, and low gradient stream reaches. Swan Lake has an example of a freshwater wetland at its northern shore (Figure 5). Vegetation in freshwater wetlands includes submergent plants such as pond lily *(Nuphar polysepalum)* and pondweed *(Potamogeton gramineus)*, as well as emergent plants such as marestail *(Hippurus vulgaris)*, horsetail *(Equisetum fluviatile)*, two species of grasses *(Deschampsia beringensis* and *Calamagrostis canadensis)*, and one species of sedge *(Carex sitchensis)*. Figure 6 shows a typical vegetation profile for Swan Lake freshwater wetland. Freshwater wetlands provide food and cover for waterfowl and fish. They also export nutrient energy to adjacent rivers, lakes, and streams.

D. *Muskegs* - Muskegs are localized patches of poorly drained soils found throughout coastal forests and the alpine zone. Typical muskeg plant communities consist of sphagnum mosses *(Sphagnum* spp.*)* and sedges *(Carex* spp.*)* interspersed with lodgepole pine *(Pinus contorta)*, Alaskan yellow cedar *(Chamaecyparis*

Figure 5. Swan Lake, Freshwater Wetland

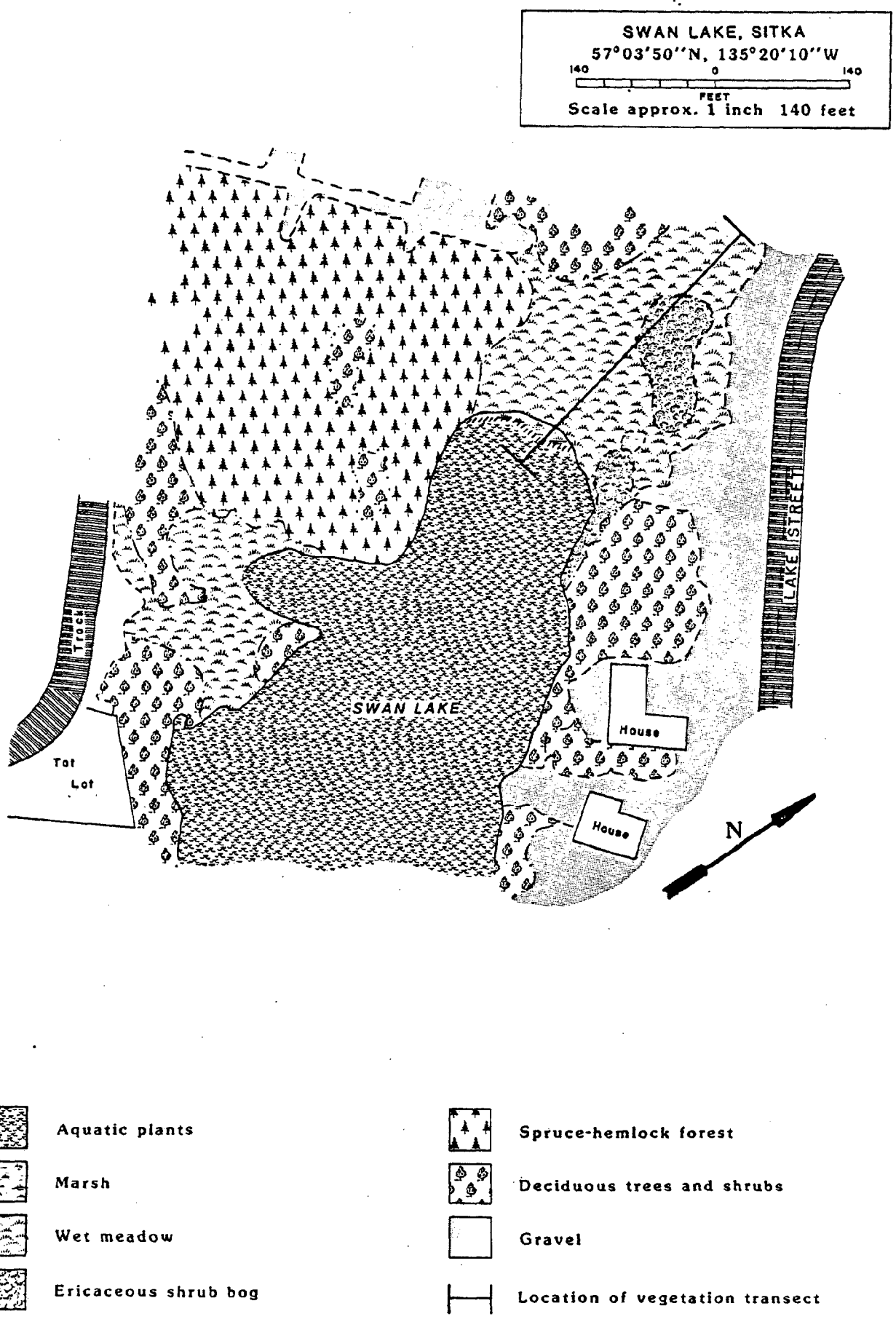
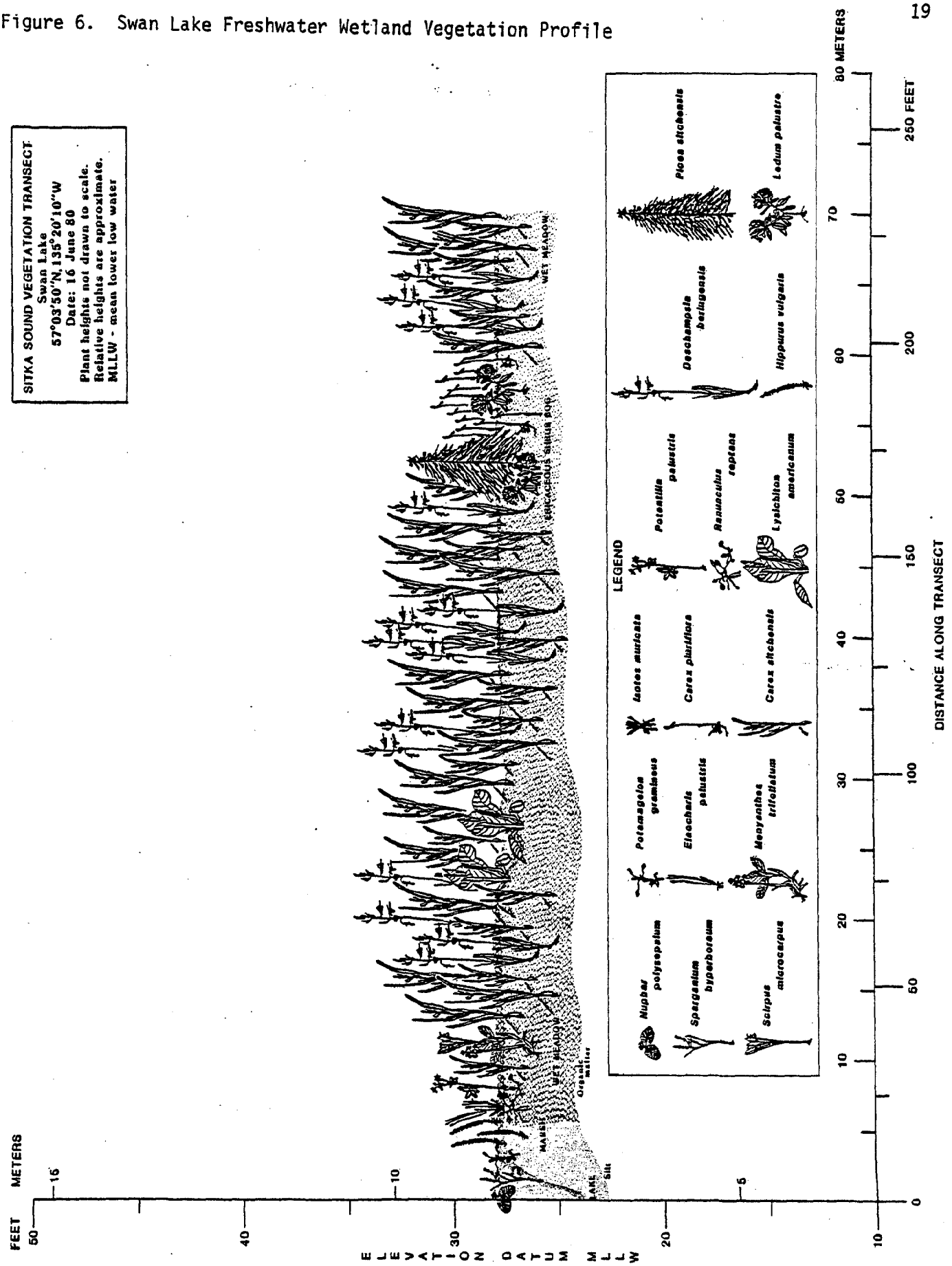


Figure 6. Swan Lake Freshwater Wetland Vegetation Profile



nootkatensis), crowberry *(Empetrum nigrum)*, labrador tea *(Ledum palustre)*, skunk cabbage *(Lysichiton americanum)*, and bracken fern *(Pteridium aquilinum)*. Muskegs comprise the largest wetland type within the Sitka area. Bear, deer, and several bird species utilize muskeg areas on a seasonal basis. Muskegs may function as either hydrologic reserves or hydrologic sinks. The peat deposits found in muskeg bogs can serve as large sponges capable of soaking up peak rainfall to be released into adjacent streams during periods of low flow. Other muskegs can effectively trap water and contribute little flow to adjacent watersheds. Further research on the hydrology of muskegs is warranted.

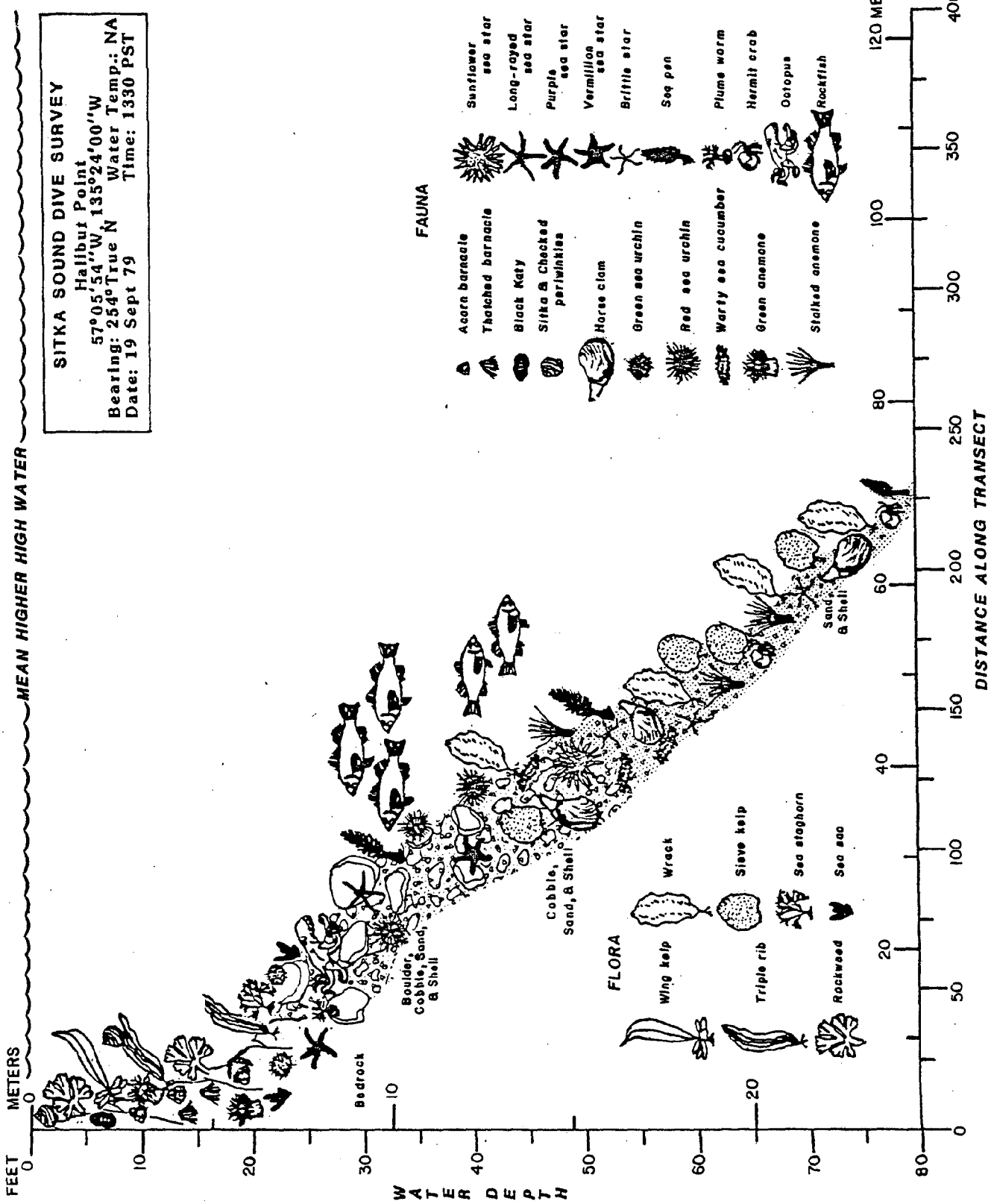
Of the four wetland types, the coastal wetlands and estuarine tidal flats were found to provide the most important wetland habitat. They provide feeding and resting areas for a large proportion of the migrant and resident waterfowl and shorebirds of Sitka Sound. The marine invertebrates and plants associated with estuarine tidal flats are an important food source for waterfowl, fish, and shellfish. The plant species present in coastal wetlands provide high protein food for Sitka black-tailed deer, brown bear, ducks, and geese. Brown bear and bald eagles feed on spawning salmon in streams and estuaries contiguous to wetlands. Eelgrass beds provide spawning substrate for herring and rearing habitat for juvenile salmon and shellfish.

3. Marine/Estuarine Habitats. A variety of marine habitats within Sitka Sound ranging from quiet embayments to exposed rocky shores were sampled through subtidal and intertidal surveys. The rich variety and abundance of marine life in Sitka Sound is due in large measure to the diversity of the nearshore habitats found in the region. Two habitat types, steep rocky shores and estuarine tidal flats, are characteristic of many of the marine habitats surveyed.

A. *Steep Rocky Shorelines* - Steep rocky shorelines, including Halibut Point (Figure 7), provide substrate for the attachment of large marine algae, such as kelp and seaweed. Marine algae are an important source of primary productivity in Sitka Sound. The algal communities and their associated rocky substrates provide habitat for rockfish, herring, and forage fishes. Diverse and rich invertebrate fauna, including abalone, shrimps, and scallops are also found in rocky shoreline areas.

B. *Estuarine Tidal Flats* - The intertidal and shallow subtidal habitats are limited in Sitka Sound owing to the steep bathymetry of the area. Estuarine tidal flats are generally restricted to the heads of bays, mouths of creeks, or in small coves where sediments collect. Estuarine tidal flats, such as Totem Park, were found to be a generally productive and limited resource in Sitka Sound where steep rocky shorelines are a far more abundant habitat. Dense clam, worm, and eelgrass beds

Figure 7. Halibut Point Shore Zone Profile



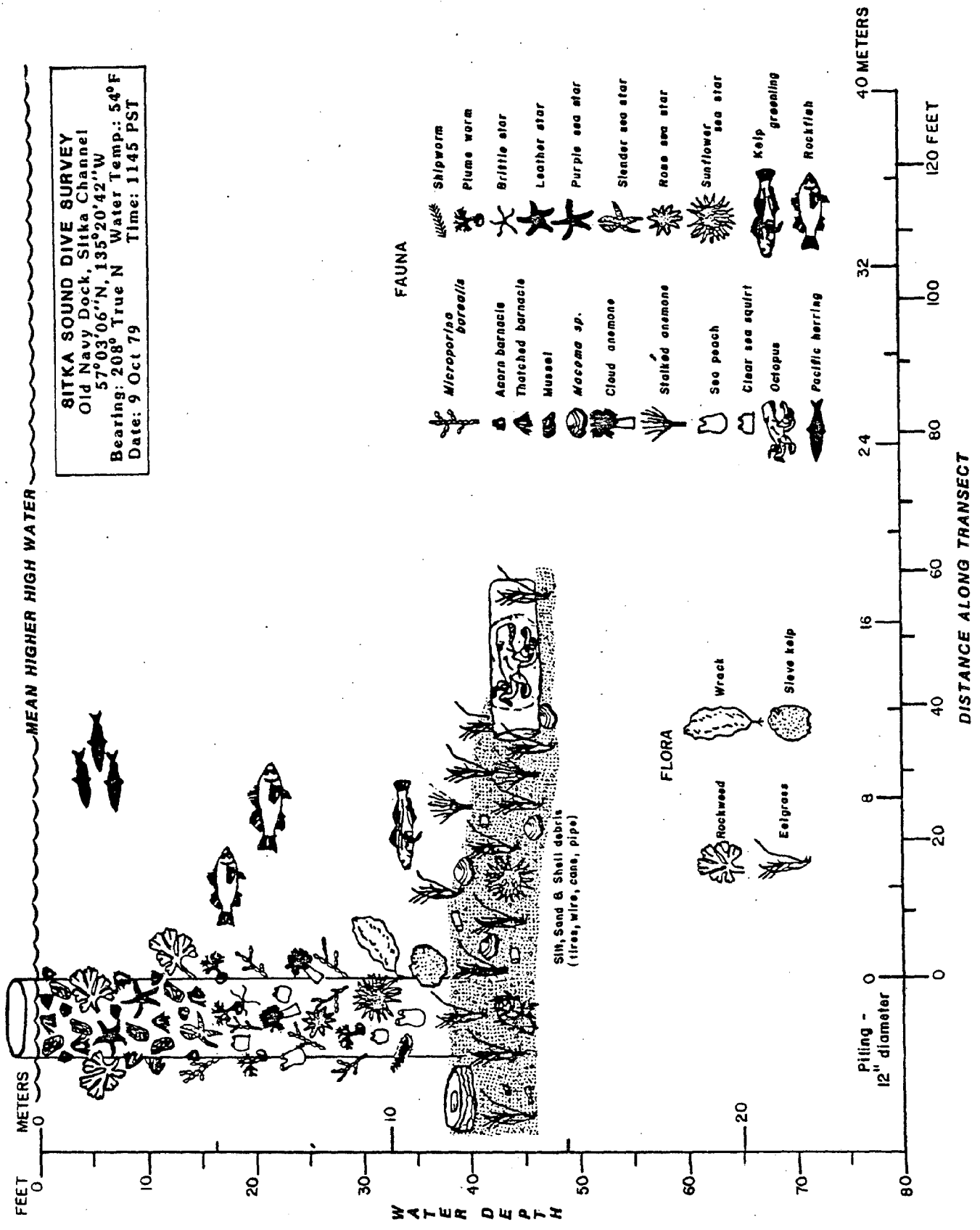
were characteristic of Sitka estuarine tidal flats. These areas were found to provide essential rearing areas for juvenile salmonids, herring, shrimp, and crabs. Birds, adult fish, and crabs are attracted to estuarine tidal flats to feed on clams and worms. Eelgrass beds are utilized as spawning areas by herring.

C. *Man-made Habitats* - Man-made marine habitats include piling supported docks such as the Old Navy Dock (Figure 8). This dock structure was found to have a rich and diverse assemblage of marine life including numerous invertebrate species, herring, rockfish, scallops, octopus, and juvenile forage fishes.

4. Sitka Sound Circulation - Productivity in the offshore marine area is closely related to circulation. The upwelling of nutrient rich waters along the coast and subsequent mixing with freshened inshore waters has a determinant effect upon primary productivity and the basis of marine food webs. The seasonality and retention time of fish and shellfish larvae in gyre systems influences the location and productivity of fishing grounds. Circulation also effects the pathways, assimilation and concentration of pollutants in the marine environment.

A. *Regional Net Circulation* - The regional net circulation within Sitka Sound is integrally related to the offshore circulation

Figure 8. Old Navy Dock Profile



in the Gulf of Alaska. Coastal waters of the northward flowing Alaska Current enter Sitka Sound from the south and exit to the north around Cape Edgecumbe. A cyclonic (counterclockwise rotating) gyre in the outer portion of Sitka Sound is suggested by the results of the drift bottle study (Figure 9). Southwestward transport along the inside coast of Kruzof Island was also demonstrated.

The influence of oscillatory tidal currents is most evident along the eastern and northern shores of the Sound and in the straits and passages to the north of the Sound. Small local eddies generated by tidal currents, particularly in the nearshore region, are common in this area. There appears to be little if any net northward flow into Nakwasina Sound, and only limited net northward flow into Olga Strait and Hayward Strait. Surface flow from Silver Bay and Katlian Bay is strongly towards the direction of Sitka Sound.

B. *Local Circulation* - The local net circulation in the vicinity of Sitka was shown to be northwestward, parallel to the coast (Figure 10). Nearshore data indicate that Japonski Island diverts most of the flow to the west around Makhnati Island and that little surface water passing the east entrance to the Sitka Waterfront Channel actually enters the channel. Circulation into Mt. Edgecumbe Lagoon (Sealing Cove) indicates that this embayment receives a high flushing rate.

Figure 9. Sitka Sound Net Circulation

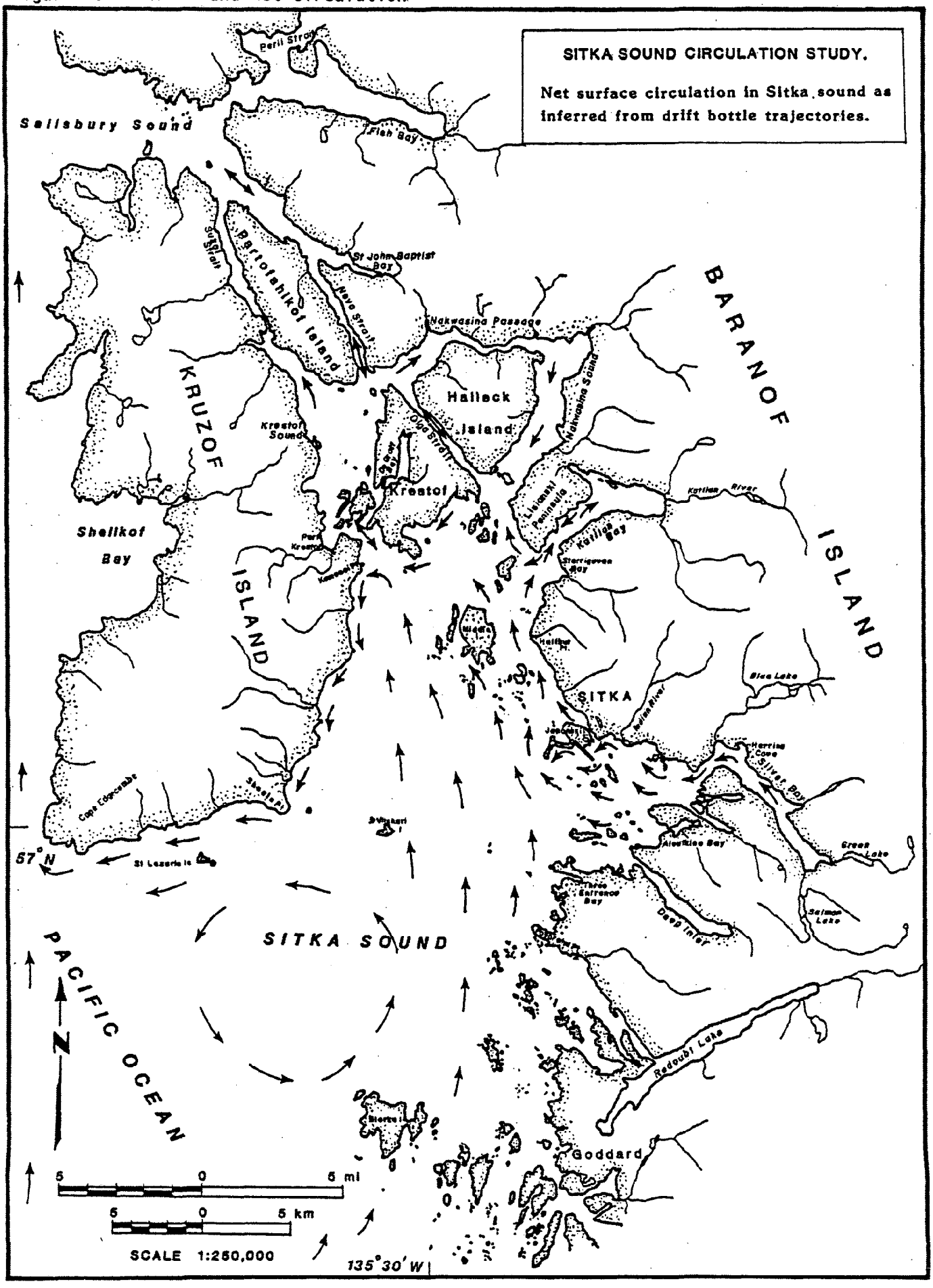
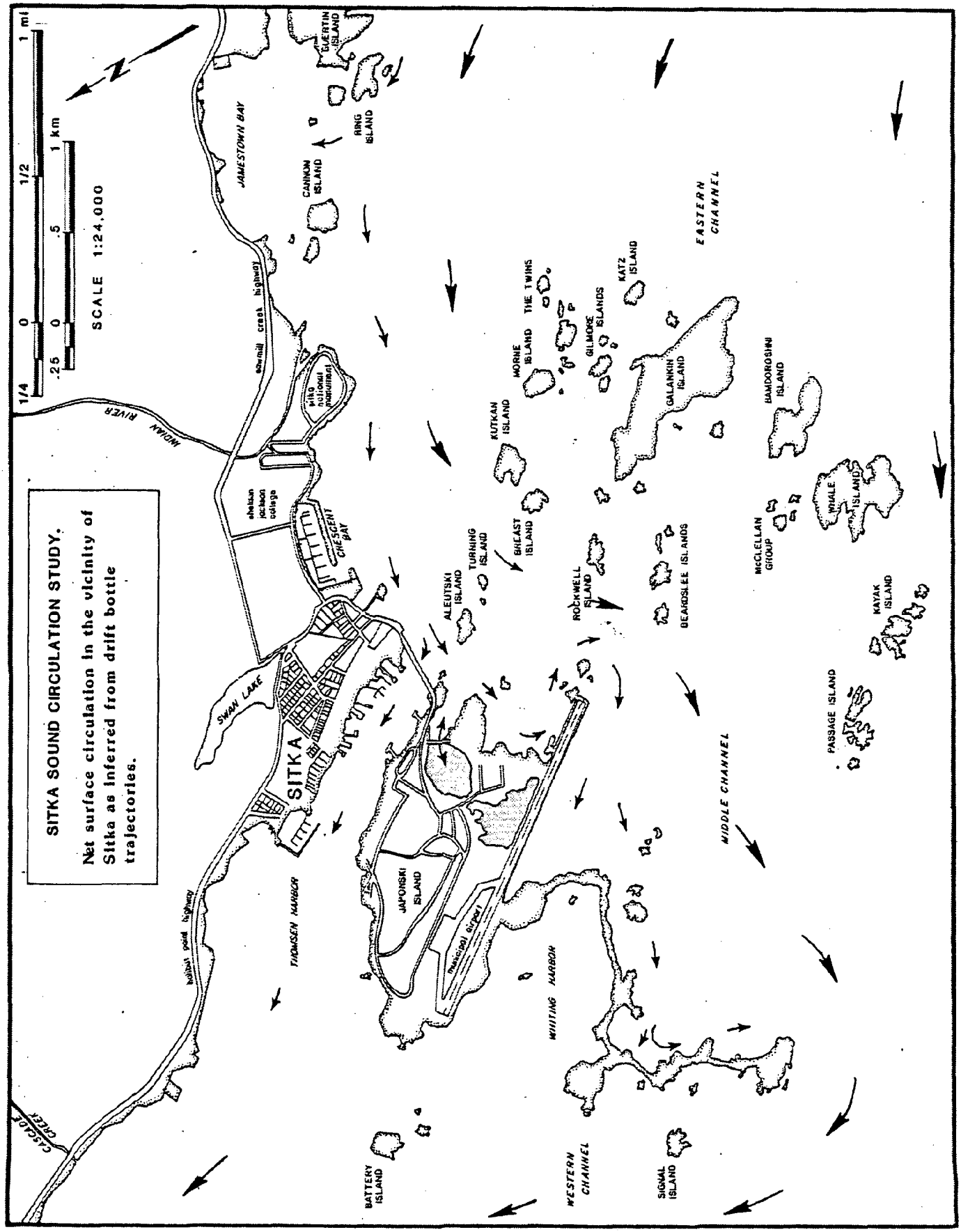


Figure 10. Sitka Waterfront Net Circulation



MANAGEMENT RECOMMENDATIONS

Tables 3 and 4 summarize the relative habitat values and sensitivities for the Sitka "urban" area. Two types of habitat management recommendations, general and site-specific, are proposed for Sitka's Coastal Management Program.

General Recommendations

1. Freshwater Habitats. All freshwater systems surveyed, with the exception of Swan Lake and its tributaries, support anadromous fish populations. To maintain anadromous and resident fish populations and associated wildlife, land and water uses involving anadromous streams should be designed to conserve existing habitat. The most important stream habitats found within the Sitka "urban" area include: Katlian River, South Fork Katlian, Starrigavan Creek, No Name Creek, Granite Creek, Indian River, Sawmill Creek, Medvejie Creek, and Salmon Creek. Other streams found to support anadromous fish include: Coxe River, the four unnamed streams along the south shore of Katlian Bay, Channel Club Creek, Turnaround Creek, Blueberry Lane Creek, Cascade Creek, Thimbleberry Creek, Herring Cove Creek, and three unnamed creeks along the east shore of Silver Bay.

Table 3. Relative Fish and Wildlife Resource and Habitat Values Within the Sitka Urban Area

H=High, M=Medium, L=Low, NA=Not Applicable

	Herring Spawning	Herring Feeding	Salmon Spawning	Salmon Rearing	Bottom Fish	Shellfish	Clams	Productive Wetlands*	Kelp Beds+	Bald Eagles	Waterbirds	Deer	Bear	Small Mammals	Marine Mammals
Katlian	H	H	H	H	M	H	H	H	L	H	H	H	H	H	H
Starrigavan	H	H	H	H	M	H	H	H	M	M	H	M	M	H	H
Harbor Pt.-Halibut Pt.	H	M	M	H	H	M	H	H	H	M	M	M	M	M	H
Mile 1.7-3.5, Halibut Pt. Rd.	H	M	L	M	M	M	M	M	M	M	L	L	M	M	H
Seaplane Turnaround Cove	H	M	L	H	M	M	H	H	L	M	H	L	L	L	M
Sitka Channel	L	M	L	M	M	M	L	M	L	M	M	L	L	L	M
Swan Lake	NA	NA	NA	NA	NA	NA	NA	M	NA	M	H	L	L	L	NA
Islands N. of Japonski I.	H	M	L	M	H	H	H	M	H	H	H	M	M	H	H
Japonski I. and Causeway	H	M	L	M	H	M	M	M	H	H	H	M	L	M	H
Islands S. of Japonski I.	M	M	L	M	M	M	M	M	L	H	M	M	L	M	H
Castle Hill-Crescent Harbor	L	M	L	M	M	M	M	M	M	M	M	L	L	L	M
Totem Park	L	M	H	H	M	M	H	H	M	H	H	M	L	M	M
Jamestown Bay	L	M	L	M	M	M	M	M	L	M	L	M	L	M	M
Thimbleberry Bay	L	M	M	M	M	M	M	M	M	M	M	M	L	M	M
Silver Bay	L	M	H	H	M	H	M	M	L	M	M	H	H	H	H

*includes intertidal zones and sea grass beds
+includes both attached, floating, and submerged algal beds

Table 4. Relative Sensitivities of Habitats Within the Sitka Urban Area to Development Impacts

H=High, M=Medium, L=Low, NA=Not Applicable

	Fills* (high intertidal)	Fills* (low intertidal)	Fills* (wetlands**)	Oil Spills	Liquid Waste# Disposal (organic)	Liquid Waste# Disposal (inorganic)	Dredging & Gravel Extraction	Noise and Disturbance	Stream and Watershed Damage	Increased Access
Katlian	M+	H	H	H	L+	M+	M+	M+	H	M+
Starrigavan	M+	H	H	H	M	M+	M+	M	M	M
Harbor Pt.-Halibut Pt.	M+	H	M	M	L+	M+	L+	M	M	M
Mile 1.7-3.5, Halibut Pt. Rd.	L	M	L	M	L	M+	L+	L	M	L
Seaplane Turnaround Cove	M	H	L	H	M	M+	H	M	M	M
Sitka Channel	L	M	L	M	L	M	L+	L	L	L
Swan Lake	NA	NA	H	H	H	H	H	M	H	M
Islands N. of Japonski I.	M+	H	M	M	L+	M	M+	M+	M	M+
Japonski I. and Causeway	M	M+	L	M	L+	M	L+	L+	L	M
Islands S. of Japonski I.	M	M+	M	M	L+	M	L+	L+	L	M
Castle Hill-Crescent Harbor	M	M	L	M	M	M+	L+	L	L	L
Totem Park	H	H	H	H	M	M+	M+	M	M+	M
Jamestown Bay	L	M	L	M	M	M	L+	L	M	L
Thimbleberry Bay	M	H	L	H	M	M+	M+	L+	M	M
Silver Bay	M	H	H	M	L+	M+	L+	M+	M+	M+

*assumes only clean shot rock or like material is used
**includes freshwater wetlands and coastal marshes
#assumes discharge is treated to meet State water quality standards
+specific locations may have higher sensitivity

The following guidelines are suggested for the habitat management of anadromous streams:

A. To prevent unneccessary encroachment upon the stream channel, its banks, and associated floodplain, new construction and land clearing should be buffered by a riparian zone of a minimum of 25 feet of vegetation along either side of the 50 year floodplain of the following small streams: Coxe River, the four unnamed streams along the south shore of Katlian Bay, Channel Club Creek, Turnaround Creek, Blueberry Lane Creek, Cascade Creek, Thimbleberry Creek, Herring Cove Creek, and the three unnamed creeks along the east shore of Silver Bay. Because of their special importance and sensitivity, the following streams should be buffered by a minimum of 50 feet of riparian vegetation along either side of the 50 year floodplain. They are: Katlian River, South Fork Katlian, Starrigavan Creek, No Name Creek, Granite Creek, Indian River, Sawmill Creek, Medvejie Creek, and Salmon Lake/Creek.

These streamside development recommendations are intended to be general guidelines and do not substitute for site-specific project evaluation by trained resource specialists. On-site evaluations may indicate either wider or narrower

buffer zones or alternative protection measures as each case merits.

B. Impacts from necessary instream work such as culverting, bridge construction, streamside road construction, channelization, bank stabilization, damming, gravel extraction, and stream diversion can be mitigated or minimized by submitting plans and specifications for review by trained resource specialists. These specialists can be found in the private sector or in government agencies including the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, and U.S. Forest Service. The law requires submitting plans and specifications to the Alaska Department of Fish and Game, Habitat Protection Section, 230 South Franklin Street, Juneau, 99801, for work affecting streams cataloged under the provisions of the Anadromous Fish Act (A.S. 16.05.870). Nearly all streams in the Sitka area are affected by this law.

C. Existing fish passage problems, including perched culverts, man-made stream obstructions, and velocity barriers should be corrected whenever routine maintenance is scheduled. Fish passage problems were noted on Channel Club Creek, Turnaround Creek, Blueberry Lane Creek, and Herring Cove Creek.

2. Wetlands Habitats. Our general management recommendations for wetlands place a high value on protecting coastal wetlands and estuarine tidal flats from destruction, pollution, excessive noise, and disturbance.

   A. Coastal wetlands and estuarine tidal flats should be avoided when siting industrial operations, log transfer and storage, roads, landfills, and permanent structures.

   B. Traditional wetland activities, including recreational and subsistence hunting, fishing, clamming, beach walking, etc., should be protected when making land use decisions regarding wetlands.

   C. Offroad motorized vehicle use in coastal wetlands and tidal flats should be discouraged because of its disruptive effect upon bird life, plants, infauna, and the substrate.

   D. Under certain circumstances, selective gravel removal, particularly in marsh areas above tidal influence, may be allowed when performed under the supervision of fisheries and wildlife biologists. Observations made during the study showed that ponds created by gravel removal in the Nakwasina (Figure 11) and Starrigavan (Figure 12) wetlands,

Figure 11. Nakwasina Coastal Wetland

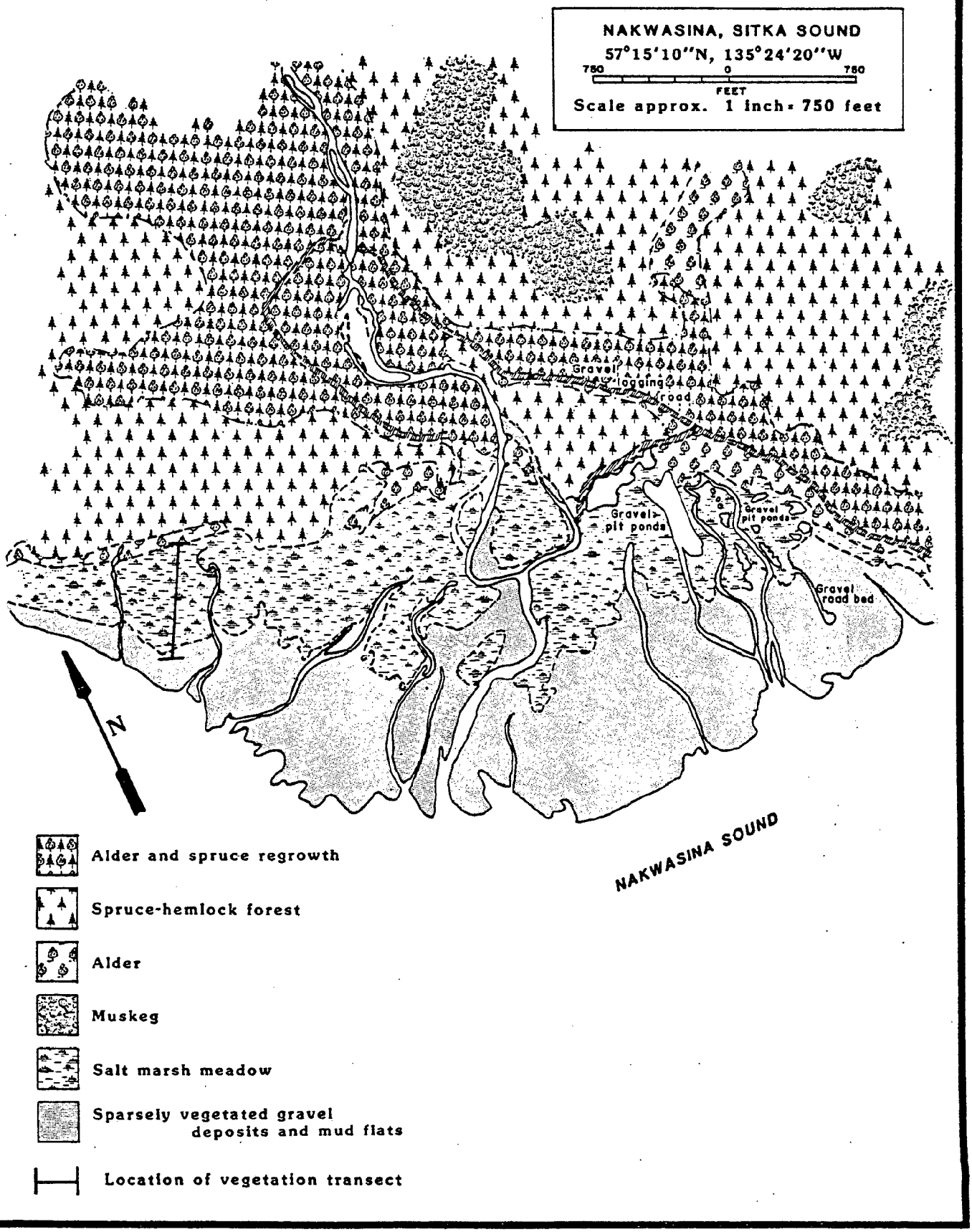
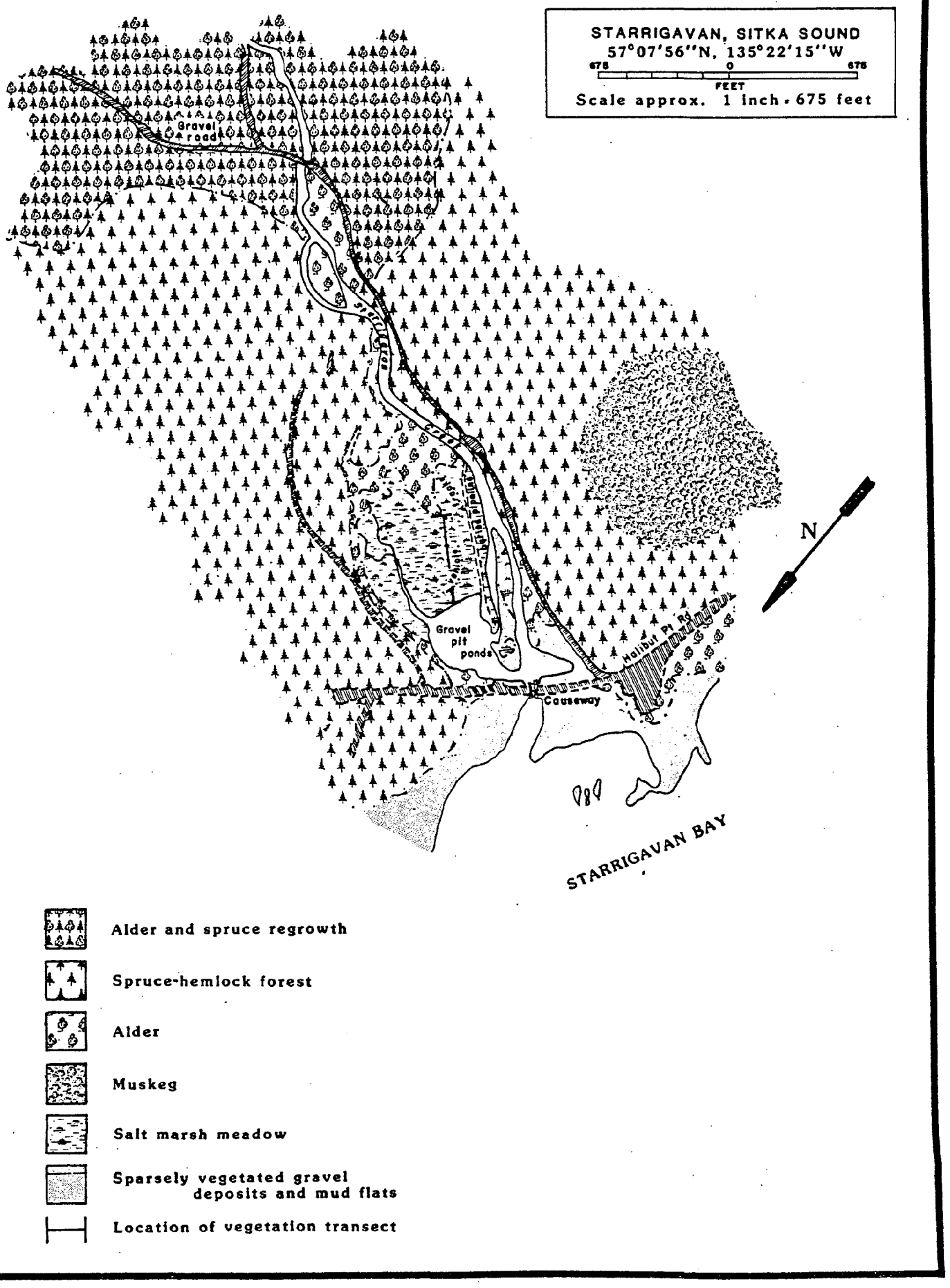


Figure 12. Starrigavan Coastal Wetland



which have few natural ponds, enhanced waterfowl usage of those areas.

E. To minimize encroachment on coastal wetland habitat from adjacent land uses, a buffer zone consisting of a minimum of 50 feet of natural vegetation should be retained landward of the upper fringe of beach rye grass *(Elymus arenarius)*. Exceptions to this general guideline may be made on a case-by-case basis if the buffering effect is sufficient through other methods. This should be determined through site-specific evaluation by trained resource specialists.

F. Projects that must be sited on coastal wetlands and estuarine tidal flats should continue to be individually reviewed through the U.S. Army Corps of Engineers 10/404 permit process. Freshwater wetlands, such as those occurring in conjunction with Swan Lake and Salmon Lake, should also be managed on an individual permit basis. The proposed Swan Lake Area Meriting Special Attention offers detailed management guidelines for the remaining freshwater wetlands adjacent to Swan Lake. The Swan Lake AMSA proposal is available as a separate document.

G. We suggest that development of muskeg areas along the Sitka road system can be handled under general permit

guidelines, to be developed jointly by the Corps of Engineers, the City and Borough of Sitka, and the appropriate resource agencies. The hydrological values of muskegs may deserve further study, particularly their contribution to anadromous streams during low flow periods.

3. Marine/Estuarine Habitats. Due to the generally steep topography of the shoreline in the City and Borough of Sitka, intertidal and shallow subtidal habitats should be considered a limited and valuable resource. These habitats were found to: 1) support the bulk of herring spawning, 2) provide important rearing and feeding areas for juvenile salmonids and crustacean larvae, 3) export plant nutrient energy to Sitka Sound, 4) support local bird populations, and 5) provide the basis for many marine food webs. As a general rule of thumb, projects that increase the wetted surface area will enhance habitat, those that decrease the wetted surface area will decrease habitat. The following general guidelines are suggested:

   A. A City policy should be adopted that encourages alternatives to filling out from the shoreline into tidelands to create waterfront lands. Waterfront developments that utilize piling supported or floating structures in their design should be encouraged over those that utilize solid

tideland fills. Where solid fills are in the public interest, measures to minimize or mitigate adverse impacts on habitat should be sought by working with resource specialists prior to submitting 404/10 permit applications to the U.S. Army Corps of Engineers.

B. Judicious use of fill, such as in breakwater construction, can diversify habitat resulting in the attraction of certain desirable fish species. In many cases additional surface area is being created. Working with resource specialists during the siting and designing of harbor facilities and breakwaters will help to protect habitat values and facilitate Corps permit reviews.

C. Observations made during intertidal and current studies suggest that the decision of the City to consolidate sewage collection and treatment in one deep water outfall south of the runway is a good one. Our observations also suggest that with the anticipated low volumes and nature of Sitka's domestic sewage effluent, a primary treatment facility discharging into well mixed waters is probably adequate to protect habitat values in Sitka Sound. Secondary treatment may be required as the City grows and develops.

D. The results of underwater surveys between Japonski Island and Eastern Channel including Ball Islets (Figure 13) indicate that subtidal macrophyte (kelp) communities may be limited at depths normal for macrophyte growth elsewhere in Sitka Sound. Whether this is due to shading from the sulphite waste liquor plume from the ALP mill or other factors could not be determined from our study. It is known that very little herring spawning occurs in this area (Figure 14). Further study on the effect of the mill effluent upon marine algae and herring spawning, particularly in the area between the Japonski Island causeway and Silver Bay is recommended.

Specific Recommendations

1. Granite Creek. Problems associated with heavy siltation caused by gravel pit operations in the upper reaches of Granite Creek are being controlled by the current operator through the use of settling ponds. As the City expands its gravel pit operations we recommend that the maintenance of water quality and spawning habitat be given a high priority for future planning and expansion of the pit. We recommend that the City develop a gravel pit mining plan with the assistance of the Alaska Department of Environmental Conservation, Alaska Department of Fish and Game, and U.S. Fish and Wildlife

Figure 13. Ball Islets Shore Zone Profile

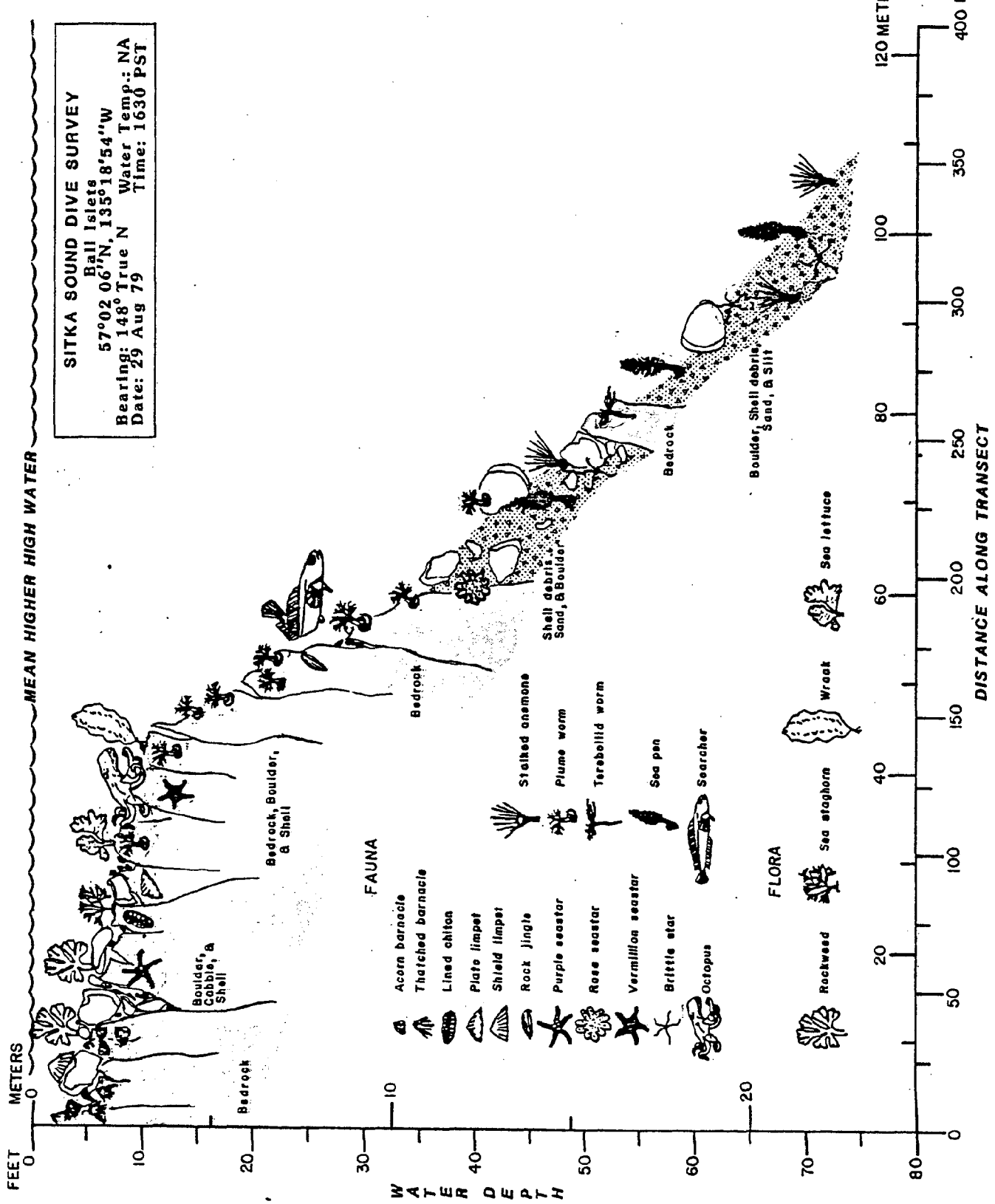
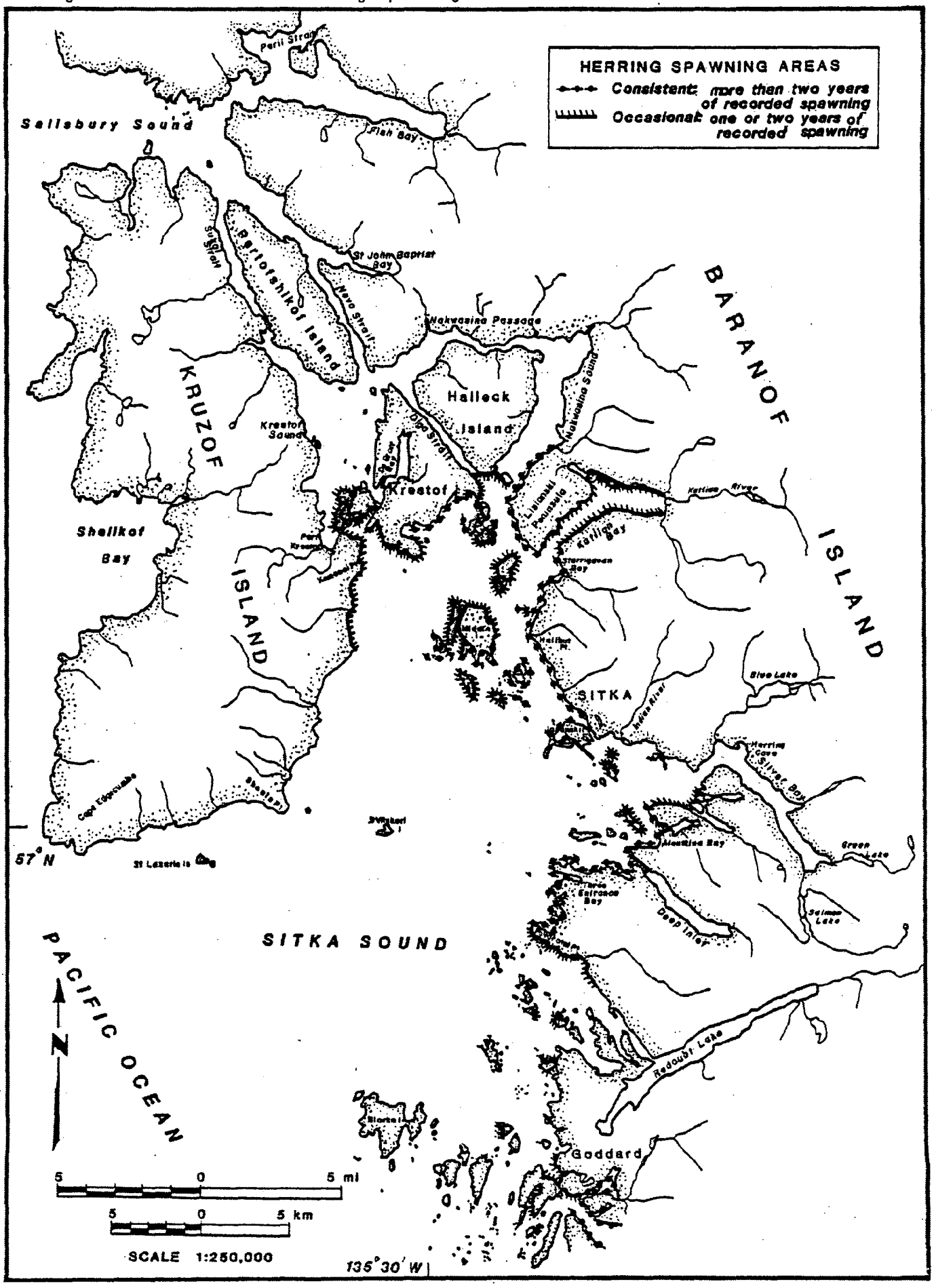


Figure 14. Sitka Sound Herring Spawning Areas



Service. The plan would address water quality and habitat protection as well as pit reclamation and restoration.

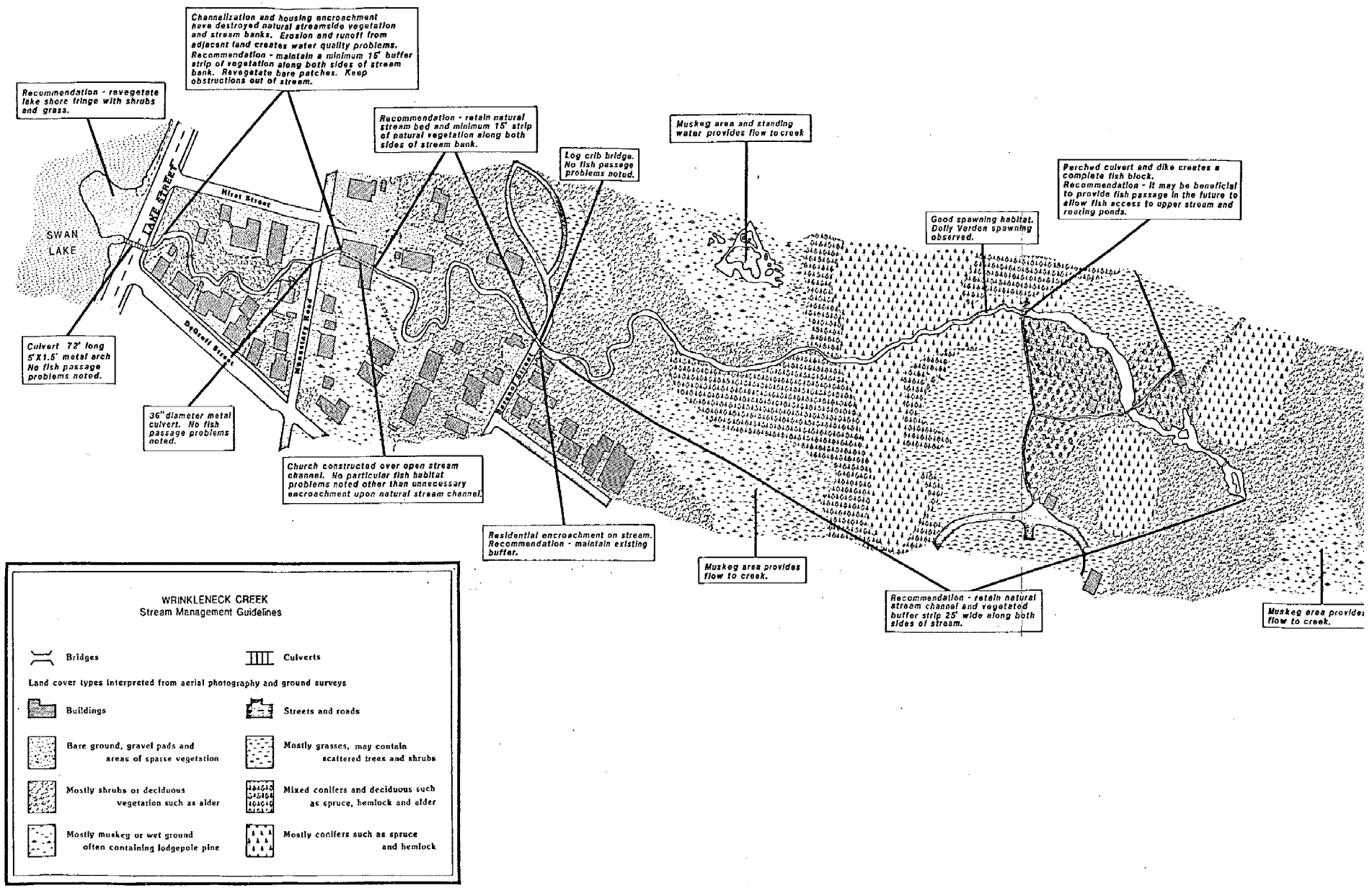
2. Turnaround Creek. The City landfill operation has degraded water quality in Turnaround Creek through high turbidity and leacheates and has created a chronic water pollution problem that may last for many years after this site is abandoned. Recent analysis of juvenile coho salmon and Dolly Varden char taken from Turnaround Creek suggests abnormally high amounts of zinc, arsenic, and polychlorinated biphenols (PCB) in fish tissue samples. We recommend that a rigorous program of water quality monitoring be undertaken by the Alaska Department of Environmental Conservation above and below the landfill, and that steps be taken to determine if State water quality and public health standards are being met. If not, the landfill and drainage situation should be corrected and measures taken to insure that the operation meets accepted environmental standards.

3. Swan Lake. Swan Lake and its two tributaries, Arrowhead Creek and Wrinkleneck Creek, provide recreation, aesthetic, and habitat values to the community. Our surveys indicate that the current trend toward filling and associated development along the lakeshore and in the wetlands at the north end of the lake threatens certain habitat values, particularly the

continued use of the lake by migrating waterfowl including trumpeter swans. There is also a need to protect the stream flow and fish habitat within the two tributary streams that support the lake ecosystem (Figure 15). Protection of the lake ecosystem and its associated values can be best served by a comprehensive lake, stream, and shoreline management plan that accommodates both the legitimate rights of property owners and the public resource values of Swan Lake. We recommend that Swan Lake, its associated tributaries, marshes, and immediate shorelands be designated as an Area Meriting Special Attention (AMSA). An AMSA proposal prepared by the Department of Fish and Game, Habitat Protection Section is available as a separate report and contains detailed management recommendations for Swan Lake.

4. Indian River. Indian River represents a classic example of competing demands for limited water resources. The City presently withdraws its primary source of domestic water from Indian River; Sheldon Jackson College diverts water for hydroelectric generation and a hatchery facility; the State and Federal governments manage the watershed and must insure adequate flows for the fish and wildlife habitat; and the National Park Service considers the preservation of flow in the lower stream to be essential for protection of the natural and historical setting of the Sitka National Historical Park. Fortunately, Indian River is presently meeting all of the

Figure 15. Wrinkleneck Creek Stream Management Map



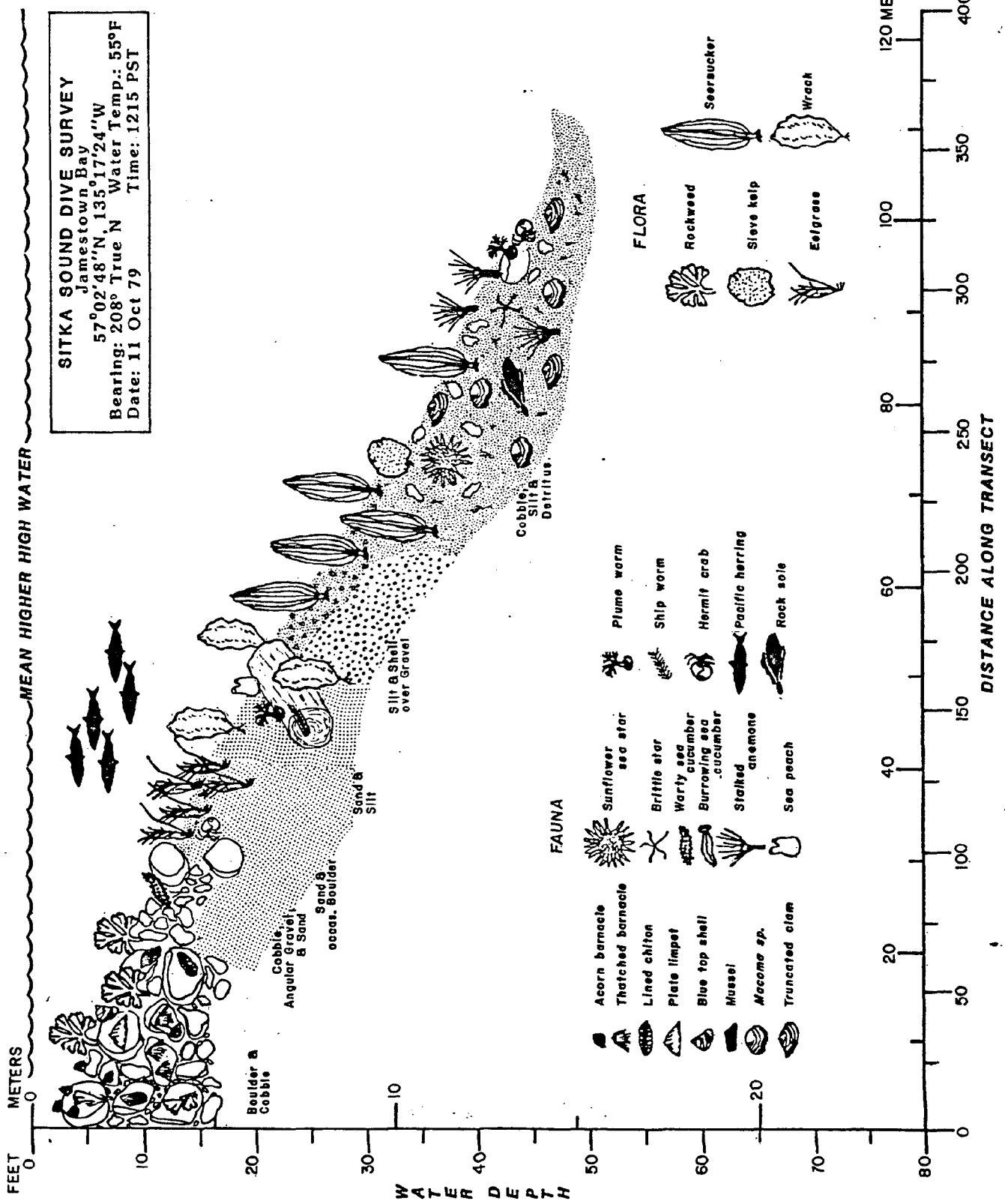
demands placed upon it. However, as demands for this finite resource increase in the future, decisions will be required to determine which user groups, if any, will have priority over others. Recognizing the need to maintain the healthy balance that now exists, the City, in cooperation with the U.S. Geological Survey and Alaska Department of Natural Resources, has initiated a data collection program to quantify the seasonal in-stream flow regimes of Indian River. If additional funding can be secured, they have agreed to participate in studies that would define both existing and future project stream flow requirements of each user group. The ultimate objective should be to devise a long range water management plan that will maintain balance among all beneficial users of Indian River. We recommend that this study move forward and that Sitka consider including an Indian River water management plan as part of its implementation of habitat management policies for the Sitka Coastal Management Program.

5. Turnaround Flats. The Old Seaplane Turnaround Flats was found to be one of the richest marine/estuarine habitats surveyed along the Sitka waterfront. The lower intertidal and shallow subtidal zone support high densities of clams, worms, eelgrass, and associated soft bottom marine invertebrates. Herring traditionally spawn at this site. Bird surveys indicate that this area is heavily used by waterfowl and shorebirds for

feeding and resting. While this area is currently influenced by an intertidal sewage outfall, our studies suggest that the productivity of this site will remain high after the sewage discharge is eliminated. To protect the rich mud flats and eelgrass bed habitat of Old Seaplane Turnaround Flats, no solid filling or tideland destruction should be allowed below the 5.0 foot tide line (MLLW). Any proposed design for tideland fill or alteration at this site should be reviewed on a case-by-case basis by resource agencies. The proposed burial of a sewage trunk line should have only a temporary and localized impact upon the habitat as long as activities are confined to the immediate vicinity of the line installation.

6. Jamestown Bay. Underwater surveys confirm that Jamestown Bay, and in particular, the northwest shore show evidence of habitat degradation due to tideland development and siltation. Our studies did not find any critical habitat values in Jamestown Bay, although this area was once utilized for herring spawning. We did find juvenile herring during one of our surveys (Figure 16). The shoreline is already partially committed to industrial and commercial purposes. From a habitat standpoint, Jamestown Bay is less sensitive to shoreline alteration than other embayments such as Thimbleberry Bay and Starrigavan Bay.

Figure 16. Jamestown Bay Shore Zone Profile



7. Future Commercial and Industrial Development. Areas already industrialized, such as Sitka Channel and Sawmill Bay, should be given the highest priority for sighting future water-dependent commercial and industrial development while reserving other more sensitive shorelines for residential use, public recreation, and habitat. Future industrial and commercial waterfront expansion into Starrigavan Bay is not recommended at this time because of the availability of less sensitive areas notably the Sitka Channel, Sawmill Bay, and Jamestown Bay.

   In all waterfront development we encourage the use of pile supported structures to avoid the unnecessary filling of tideland habitat. Besides their effect upon removing productive tidelands, solid fills can force juvenile salmonids out of relatively protected shallow feeding areas into deeper water where they become prey to a host of offshore species including rockfish and sculpins. Where fills and causeways are neccessary, a breach in the low intertidal area may be neccessary to protect juvenile salmonid migration.

SUMMARY

In summary, the rich variety and abundance of natural resources and the high quality of life found in Sitka is due in large measure to the diverse and productive fish and wildife habitats present in the coastal zone. Local fish and wildlife resources have been shown to be of considerable

socio-economic value to the community and will continue to provide both tangible and intangible benefits with wise use and management.

Our studies have identified many of the important habitat areas present within the urban area of Sitka. We have made recommendations based upon our best professional judgement and experience as to how these habitats can be protected, acknowledging that Sitka will continue to grow and develop and the certain losses of habitat quality and diversity are probably unavoidable. It is now up to the City and Borough of Sitka and the local citizens to consider these recommendations and assume the bulk of responsibility for conservation and management of their shared habitat resources on a day-to-day basis.

It is hoped that Sitka's Coastal Management Program will produce future cooperative efforts between resource managers, government regulators, developers, and the public in all sectors and levels of authority.

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